



AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior listing of claims for the present application.

Claims 1-21 (canceled)

22. (currently amended) A method of forming a copper interconnect structure providing electrical connection for a semiconductor device, comprising the steps of:

forming a first contact opening into a first insulating layer formed over a semiconductor substrate;

forming a conductive plug in said first contact opening;

forming a second insulating layer over said conductive plug and said first insulating layer;

forming a second contact opening in said second insulating layer;

forming a barrier layer in said second contact opening;

forming a copper conductor over said barrier layer; and

forming a top heat-radiating layer on an upper surface portion of said copper conductor, said top heat-radiating layer comprising aluminum nitride passifying said upper surface portion of said copper conductor, wherein said top heat-radiating layer is formed from approximately 100 Å to approximately 1000 Å thick.

23. (original) The method of claim 22 further comprising the step of chemical mechanical polishing said copper layer and said barrier layer.

24. (original) The method of claim 22 further comprising the step of cleaning said upper surface portion of said copper conductor prior to the formation of said aluminum nitride layer.

25. (original) The method of claim 22, wherein said aluminum nitride layer is formed by deposition, to a thickness of approximately 300 Å.

26. (original) The method of claim 22, wherein said step of forming said aluminum nitride layer includes a deposition process.

27. (original) The method of claim 22, wherein said step of forming said aluminum nitride layer includes a sputtering process.

28. (original) The method of claim 22, wherein said barrier layer is formed of a refractory metal compound, said refractory metal compound being selected from the group consisting of refractory metal nitrides, refractory metal carbides, and refractory metal borides.

29. (currently amended) A method of forming an interconnect structure providing electrical connection for a semiconductor device comprising:

forming a contact opening in an insulating layer of said device;

~~depositing a conductor~~ forming a first conductive plug within said contact opening; and

forming a heat-radiating layer comprising aluminum nitride on an upper surface portion of said ~~conductor~~ first conductive plug, said aluminum nitride layer providing a heat dissipating path for said ~~conductor~~ first conductive plug, wherein said

heat-radiating layer is formed from approximately 100 Å to approximately 1000 Å thick[.]; and

depositing a second conductive plug on said heat-radiating layer.

30. (original) The method of claim 29 further comprising the step of depositing a barrier layer in said contact opening and before said step of depositing said conductor.

31. (original) The method of claim 29 further comprising the step of cleaning said upper surface portion of said conductor prior to the formation of said aluminum nitride layer.

32. (original) The method of claim 29, wherein said aluminum nitride layer is formed by deposition, to a thickness of approximately 300 Å.

33. (original) The method of claim 29, wherein said step of forming said aluminum nitride layer includes a deposition process.

34. (original) The method of claim 29, wherein said step of forming said aluminum nitride layer includes a sputtering process.

35. (original) The method of claim 29, wherein said conductor is selected from the group consisting of aluminum, gold, silver, tungsten, and copper.

Claims 36-57 (canceled).

58. (currently amended) A method of forming a copper interconnect structure providing electrical connection for a semiconductor device, comprising the steps of:

forming a first contact opening into a first insulating layer formed over a semiconductor substrate;

forming a conductive plug in said first contact opening;

forming a second insulating layer over said conductive plug and said first insulating layer;

forming a second contact opening in said second insulating layer;

forming a barrier layer in said second contact opening;

forming a first copper conductor plug over said barrier layer; and

forming a heat-radiating layer on an upper surface portion of said first copper conductor plug, said heat-radiating layer ~~comprising a continuous layer of aluminum nitride~~ passifying said upper surface portion of said first copper conductor plug, ~~wherein said heat-radiating layer is formed from approximately 100 Å to approximately 1000 Å thick~~[[.]]; and

forming a second copper conductor plug over said first copper conductor plug in contact with said heat-radiating layer.

59. (canceled).